PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Butyl-type Rubber Compositions

We, THE FIRESTONE TYRE & RUBBER COMPANY, a corporation organized under the laws of the State of Ohio, United States of America, of 1200 Firestone Parkway, Akron 17, State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a novel rubbery composition of butyl-type rubber unusually well suited for use in the sidewalls of pneumatic tyres.

Butyl-type rubber is the commercial name for the copolymer of an iso-olefin having from 4 to 7 carbon atoms with an open chain conjugated di-olefin having from 4 to 8 carbon atoms. The most commonly known butyl rubbers are copolymers of from 80 to 99½ per cent isobutylene and from 20 to 0.5 per cent isoprene.

Copolymers of the butyl type are rubbery and heat-softenable in the unvulcanized state and may be compounded with modifying oils, fillers and antioxidants and moulded and vulcanized into permanent shape. Compositions containing butyl rubber are substantially inert to the effects of oxygen, ozone and sunlight and for that reason, it would be expected that such compositions would make excellent tyre sidewall stocks.

Some disadvantages exist, however, in the use of butyl stocks in tyre sidewalls. Although resistant to the effects of weather, such stocks have poor abrasion resistance and show the marks of curb-scuffing when the finished tyre is used on a car. Poor abrasion resistance also leads to poor buffing characteristics of the tyre sidewall after the tyre comes out of the vulcanizing mould in that buffing with a wire brush or the like to clean off the mould dirt disfigures the indicia moulded on the tyre sidewall. The prior art butyl tyre sidewall stocks also had poor cohesion and during the stress of a sidewall-shaping operation such as tubing, the long ribbon formed would crack and craze to give a rough cracked surface. These and other failings make previously known butyl rubber-type white sidewalls unsatisfactory for commercial use.

In accordance with the present invention there is provided a butyl-type rubber composition particularly adapted for use in the side walls of pneumatic tyres which comprises from 70 to 90 parts of a copolymer of an iso-olefin having from 4 to 7 carbon atoms and an open chain conjugated diolefin having from 4 to 8 carbon atoms, from 30 to 10 parts of chlorosulphonated polythene and from 105 to 130 parts of a reinforcing filler comprising 15 to 40 parts zinc oxide, 20 to 47 parts titanium dioxide and 30 to 50 parts silicon dioxide, all parts by weight and based on 100 parts by weight of copolymer and chlorosulphonated polythene.

The invention also provides a pneumatic tyre comprising a staining body containing migratory staining materials, a light-coloured stainable side wall susceptible to stain by said materials, and a barrier layer between said body and said side wall comprised of 70 to 90 parts of butyl-type rubber, 30 to 10 parts of chlorosulphonated polythene, and 105 to 130 parts of a reinforcing filler comprising 15 to 40 parts zinc oxide, 20 to 47 parts titanium dioxide and 30 to 50 parts silicon dioxide, all parts by weight and based on 100 parts by weight of rubber and chlorosulphonated polythene.

In the accompanying drawing:

Fig. 1 is a fragmentary sectional view of a tyre having a sidewall of the invention;

Fig. 2 is a sectional view of a tyre having a white sidewall barrier of the invention.

Referring to Fig. 1, a white sidewall tyre generally indicated at 1, is comprised of a toroidal fabric portion 2 terminating at each edge in inextensible metal bead portions 3

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and 4. A tread 5 and black body 6 are bonded by vulcanization to the fabric 2. A white sidewall 7 (comprised of the composition of the invention) is bonded by vulcanization to the outer face of the body 6. There are no migratory staining materials in any of the elements of the tyre shown in Fig. 1.

In Fig. 2, a tyre is shown having the same construction as the tyre of Fig. 1 except that a barrier 8 comprised of the novel composition of the invention separates the white sidewall 9 from the other rubbery components of the tyre which contain migratory staining materials. Barrier 8 serves to stop migration of staining materials from the tyre into sidewall 9 to discolour that member.

An example of the novel composition of the invention in parts by weight, based on 100 parts by weight of copolymer and chlorosulphonated polythene, as it is used in a white sidewall compound for a tyre is as follows:

	Prior art white sidewall stock	*Novel stock*
Butyl rubber (about 98% isobutylene and about 2% isoprene)	100	80.00
Chlorosulphonated polythene	—	20.00
Zinc oxide	70	20.00
Titanium dioxide	20	46.00
Magnesium oxide (light calcinated)	—	4.00
Silicon dioxide	—	39.00
Stearic acid	0.85	0.85
Ultramarine blue	0.20	0.20
Polyhydric alcohol ester of hydrogenated rosin	5.00	5.00
Light mineral oil	5.00	5.00
Paraffin wax	5.00	5.00
Tetramethylthiuram disulphide	1.00	1.00
Sulphur	2.00	2.00
"Captax" (Registered Trade Mark) (2-mercaptobenzothiazole	1.50	1.50

The above composition was prepared by mixing the butyl rubber and the chlorosulphonated polythene on an open two-roll mill to form a continuous band and then slowly adding the pigments. The small amount of magnesium oxide is included to give strength to the chlorosulphonated polythene after heating. The sulphur and accelerators were held until last and added and dispersed in the composition just before it was removed from the mill to prevent partial vulcanization or "setting-up" on the mill.

The mixed homogenous mass was removed from the mill, formed into the shape of an unvulcanized tyre sidewall and vulcanized to a tyre. The unvulcanized sidewall showed excellent cohesion and did not crack during the sidewall-shaping operation. Moulded indicia protruding from the sidewall of the vulcanized tyre stood up exceptionally well under buffing. The finished sidewall had a hard surface and did not easily scuff when the tyre rubbed the curb nor did it easily pick up discolouring dirt.

The physical properties of the novel composition are much superior to the prior art butyl sidewall compositions as is shown by the following:

	Prior art butyl stock	*Butyl-chlorosulphonated polythene stock*
Modulus @ 300%	150 p.s.i.	1125 p.s.i.
Tensile strength	2300 p.s.i.	1675 p.s.i.
Elongation	910%	470%
Resistance to:		
Scuffing	Poor	Excellent
Dirt pick up	Bad	Very slight
Cured surface tackiness	Considerable	None

In addition to the example set out, it has been found that the zinc oxide content may vary between 15 and 40 parts by weight, the titanium dioxide content between 20 and 47 parts by weight and the silicon dioxide content between 30 and 50 parts by weight, all parts in this and all examples being based on 100 parts by weight total of butyl rubber and chlorosulphonated polythene. In total parts of these fillers, a range of 105 to 130 parts by weight may be used, while 115 parts by weight is preferred. The composition contains from 70 to 90 parts of copolymer and from 30 to 10 parts of chlorosulphonated polythene, by weight.

The butyl rubber used may be selected from the many available on the commercial market. The chlorosulphonated polythene used is available under the name "Hypalon" (which is a Registered Trade Mark) while the silicon dioxide used is available under the trade name Hi-Sil.

A surprising feature of the invention is the fact that the normal migratory staining materials generally found in the vulcanized rubber components of a tyre do not migrate into or through the novel composition. This feature makes the composition not only ideal for tyre white sidewalls containing migratory staining material but also as a stock for use as a barrier or partition 8 (Fig. 2) between a white sidewall which is susceptible to staining by such materials and the other components of tyres containing such materials.

WHAT WE CLAIM IS:—

1. A butyl-type rubber composition particularly adapted for use in the side walls of pneumatic tyres which comprises from 70 to 90 parts of a copolymer of an iso-olefin having from 4 to 7 carbon atoms and an open chain conjugated diolefin having from 4 to 8 carbon atoms, from 30 to 10 parts of

chlorosulphonated polythene and from 105 to 130 parts of a reinforcing filler comprising 15 to 40 parts zinc oxide, 20 to 47 parts titanium dioxide and 30 to 50 parts silicon dioxide, all parts by weight and based on 100 parts by weight of copolymer and chlorosulphonated polythene.

2. A butyl-type rubber composition according to Claim 1, which includes 80 parts of copolymer and 20 parts of the chlorosulphonated polythene.

3. A pneumatic tyre comprising a staining body containing migratory staining materials, a light-coloured stainable side wall susceptible to stain by said materials, and a barrier layer between said body and said side wall comprised of 70 to 90 parts of butyl-type rubber, 30 to 10 parts of chlorosulphonated polythene, and 105 to 130 parts of a reinforcing filler comprising 15 to 40 parts zinc oxide, 20 to 47 parts titanium dioxide and 30 to 50 parts silicon dioxide, all parts by weight and based on 100 parts by weight of rubber and chlorosulphonated polythene.

4. A butyl-type rubber composition substantially as hereinbefore described with reference to the Example.

5. A sidewall for a pneumatic tyre whenever comprised of the butyl-type rubber composition according to Claim 1 or 2.

6. A pneumatic tyre substantially as hereinbefore described and as illustrated in the accompanying drawings.

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FIG-1

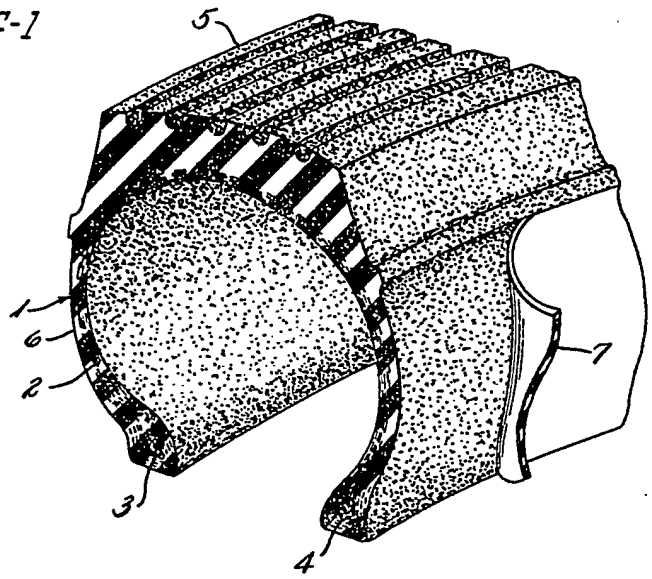

FIG-2